

CLAIMS:

1. An agitated countercurrent flotation apparatus for the separation of solids or liquids or both suspended as a separable mixture, in a fluid medium, comprising:

5 a serial array of flotation cells each having upstanding walls and a floor, which cells are in serial fluid flow communication from the first inflow cell to a final outflow cell so that a separable mixture may flow sequentially from cell to cell through the apparatus, the first cell having fluid inlet means for introducing a feed of separable mixture containing floatable liquids or solids into the apparatus and the final cell having fluid outlet means for removing processed mixture from
10 the apparatus, the serial fluid flow from the first cell to the final cell being provided by an opening in a lower portion of each common wall between adjacent cells;

15 air inlet means positioned in a lower region of each cell for introducing and controlling compressed air into each cell, so that a countercurrent flow of fluids is provided vertically within each cell;

an overflow launder for each cell for accepting a liquids or solids laden froth generated in each cell; and

20 fluid communication means extending from the overflow launder of each cell downstream from the first inflow cell to an inlet of the previous upstream cell thereby providing a means for recycling floated material so as to increase the efficiency of the materials separation being sought.

2. An apparatus as claimed in claim 1, wherein the serial array of flotation

cells consists of at least six cells.

3. An apparatus as claimed in claim 1, wherein the serial array of flotation cells is annular having a common outer peripheral wall with an upper spillway lip for each cell.

5 4. An apparatus as claimed in claim 1, wherein the air inlet means is a pipe extending through the floor of each cell.

5. An apparatus as claimed in claim 4, wherein the air inlet means is an air distributor.

10 6. An apparatus as claimed in claim 4, wherein the pipe is positioned beneath the mechanical agitation means for the cell.

7. An apparatus as claimed in claim 1, wherein each overflow launder receives a liquids or solids laden froth over an upper lip of a cell wall.

15 8. An apparatus as claimed in claim 3, wherein the launders are positioned about the upper outer peripheral wall, and each launder receives a liquids or solids laden froth over the upper spillway lip.

9. An apparatus as claimed in claim 1, wherein the fluid communication means is a pipe draining from said overflow launder into the previous upstream cell.

20 10. An apparatus as claimed in claim 9, wherein the pipe is connected into the previous upstream cell at a region approximately midway along its height.

11. An agitated countercurrent flotation apparatus for the separation of solids

or liquids or both suspended as a separable mixture, in a fluid medium, comprising:

5 a serial array of flotation cells each having upstanding walls and a floor, which cells are in serial fluid flow communication from the first inflow cell to a final outflow cell so that a separable mixture may flow sequentially from cell to cell through the apparatus, the first cell having fluid inlet means for introducing a feed of separable mixture containing floatable liquids or solids into the apparatus and the final cell having fluid outlet means for removing processed mixture from the apparatus, the serial fluid flow from the first cell to the final cell being
10 provided by an opening in a lower portion of each common wall between adjacent cells;

air inlet means positioned in a lower region of each cell for introducing and controlling compressed air into each cell;

15 mechanical agitation means for each cell comprising an upright shaft having a plurality of impellers attached to it and spaced along its length with disks being affixed to the shaft between adjacent impellers, thereby defining a plurality of flotation zones vertically within each cell, the air inlet and mechanical agitation means coacting to provide a countercurrent fluid flow vertically within each cell;

20 means for rotating and controlling the speed of the shaft;

an overflow launder for each cell for accepting a liquids or solids laden froth generated in each cell; and

fluid communication means extending from the overflow launder of each cell downstream from the first inflow cell to an inlet of the previous upstream cell

thereby providing a means for recycling floated material so as to increase the efficiency of the materials separation being sought.

12. An apparatus as claimed in claim 11, wherein the serial array of flotation cells consists of at least six cells.

5 13. An apparatus as claimed in claim 11, wherein the serial array of flotation cells is annular having a common outer peripheral wall with an upper spillway lip for each cell.

14. An apparatus as claimed in claim 11, wherein the air inlet means is a pipe extending through the floor of each cell.

10 15. An apparatus as claimed in claim 14, wherein the air inlet means is an air distributor.

16. An apparatus as claimed in claim 14, wherein the pipe is positioned beneath the mechanical agitation means for the cell.

15 17. An apparatus as claimed in claim 11, wherein the mechanical agitation means defined at least three flotation zones vertically within each cell.

18. An apparatus as claimed in claim 11, wherein the means for rotating and controlling the speed of the shaft is a motor.

19. An apparatus as claimed in claim 18, wherein a motor is a variable speed motor.

20 20. An apparatus as claimed in claim 11, wherein each overflow launder receives a liquids or solids laden froth over an upper lip of a cell wall.

21. An apparatus as claimed in claim 13, wherein the launders are positioned about the upper outer peripheral wall, and each launder receives a liquids or solids laden froth over the upper spillway lip.

5 22. An apparatus as claimed in claim 11, wherein the fluid communication means is a pipe draining from said overflow launder into the previous upstream cell.

23. An apparatus as claimed in claim 22, wherein the pipe is connected into the previous upstream cell at a region approximately midway along its height.